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UNIVERSITY RESEARCH BUILDINGS FOR SHORT-TERM GRANT PROGRAMS.

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GUIDELINES WERE ESTABLISHED TO ASSIST IN THE PLANNING AND DEVELOPMENT OF ADEQUATE FACILITIES FOR SHORT-TERM RESEARCH GRANT PROGRAMS. FUNCTIONAL CRITERIA WERRE DEVELOPED FROM THE ANALYSES OF COST STUDIES AND A SURGE SPACE STUDY AT THE UNIVERSITY OF ILLINOIS. ALTERNATIVES WERE SUGGESTED FOR THE PROVISION, PHYSICAL CHARACTERISTICS, SITE LOCATION, BUILDING TYPE AND ADMINISTRATIVE CONTROL OF THE FACILITIES. IT WAS RECOMMENDED THAT FLEXIBILITY, ECONOMY AND EXPANDIBILITY BE INTEGRATED WITH OVERALL CAMPUS PLANNING IN THE SELECTION OF AN APPROPRIATE SOLUTION. THE APPENDIX INCLUDES SEVERAL ALTERNATIVE FLOOR PLANS AND A COST BREAKDOWN FOR THE SURGE UNIT AT THE UNIVERSITY OF ILLINOIS. (JP)

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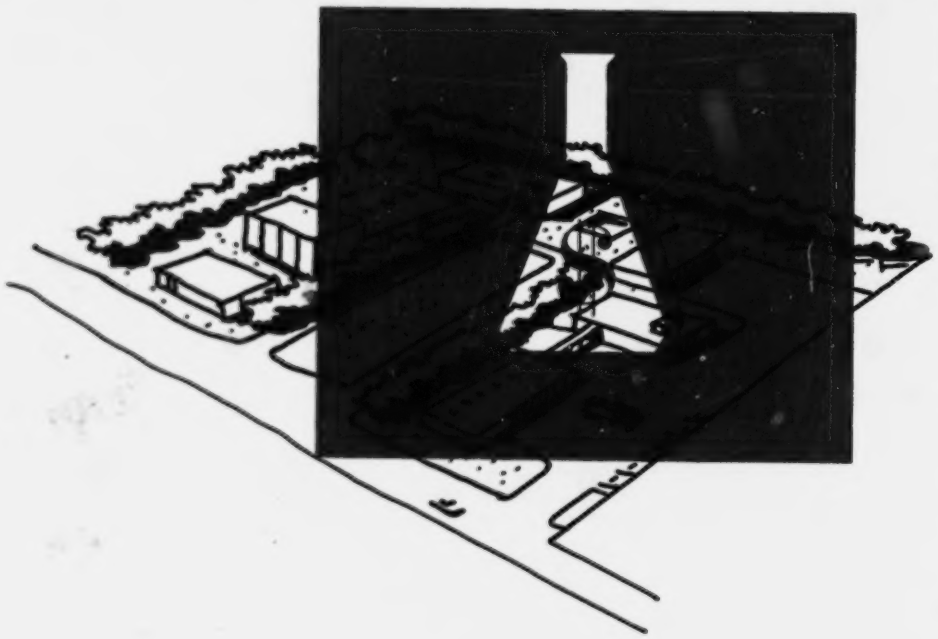

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THE BACKGROUND

Unprecedented enrollment increases in American colleges and universities are with us and ahead of us. These same institutions are greatly expanding their activities in the fields of research and service to the public. All of this adds up to the creation of a need for new building facilities in a magnitude never before experienced.

The University Facilities Research Center has recently completed a building survey while studying immediate needs for instructional, research, operating and housing construction at the large middlewestern universities comprising the Council of Ten and the University of Chicago. This survey covered the period from the end of World War *II* through the ten year forward planning time adopted by the eleven universities. It indicated that approximately $1.85 billions in construction could be expected between 1946 and 1970. Of this about $1.1 billion in construction, or 60%, is now being planned or built or projected for the near future. On a national scale, this would indicate college and university building programs amounting to something in the order of $15 billion between now and the end of this decade.

Among the objectives of the Research Center is the isolation of planning and design criteria problems, followed by the finding or developing of measures for design — all to the end of permitting the best possible use of the university and college construction dollar. Analysis of statistics and interviews and conferences with interested people in the field have contributed to the selection of several monograph subjects, of which this publication is one.

This material is aimed at aiding university and college administrators and their planning and building committee people. It is also directed at private architect and engineer firms engaged in the design and execution of new facilities.

University Research Buildings for Short-Term Grant Programs was chosen as a subject for study because this rather specialized building type is relatively new. It has been only fairly recently that outside support funds in considerable quantities have been made available to colleges and universities for the purpose of subsidizing research projects and studies. It is at the college and the university that research oriented personnel are to be found.

The problem then is how best to house this growing research activity. As much of the work is of a pilot study nature, very often the programs are arranged for limited periods of time, after which the project can be evaluated as to its worth and promise prior to a decision by the grantors and the researchers as to whether the work should terminate, continue, or be expanded in scope.

Change of program is thus the rule rather than the exception. This infers a need for flexibility of procedures, and of the facilities occupied. How can the desired flexibility in research building space be achieved with the best use of available funds?

To find answers for this basic question, and to put the findings into useful form to aid in the planning and designing of future college and university research facilities, the Research Center engaged the services of Richardson, Severns, Scheeler and Associates, Architects of Champaign, Illinois. This organization has had considerable experience in programming, planning and designing facilities for higher education. Recently they have been working with the University of Illinois, Urbana on the problem that is the subject of this monograph. The firm was selected because of this background.

The body of the report, its findings and its recommendations are very largely the work of the Consultants.

W S Kriner Jr.

Director, University Facilities Research Center
Madison, Wisconsin, December, 1961

PURPOSE OF MONOGRAPH

It is obvious that space shortage in academic and research disciplines is a common problem for institutions of higher learning throughout the country. This is certainly evident at the Big Ten Universities and the University of Chicago. Indeed, every effort is being put forward to alleviate space shortages, to make better utilization of present space, and to create new space to accommodate the rapidly expanding enrollments and research programs.

The main purpose of this study is to focus attention on one aspect of the institutions' space needs and to offer possible solutions to satisfy such needs. In particular, it documents the experience of the University of Illinois as a possible guide for other institutions. At the same time it takes into account the fact that the problems at the separate institutions are unique and as a consequence, no all-inclusive recommendations have been made.

Another purpose of the study is to provide a tool to institutions and their staff members to assist in their procurement of research grant support funds.

By suggestion and possible selection of means of procuring space for short term grant programs, the chances of such procurement may be greatly enhanced and the time involved in such procurement may be greatly diminished.

A third purpose of the study is to point out to all concerned the variety of problems involved in space procurement for short term programs. This is important in that often the research man cannot always understand the problems of the university administration in providing physical facilities. By recognizing some of the facets of space procurement, a better understanding of the disciplines and agencies involved may be achieved and thus costly delays and irritating misunderstandings may be avoided.

SPACE NEEDS FOR SHORT TERM GRANT PROGRAMS

(a) General Needs

It is hardly necessary to point out the tremendous acceleration in research activity in the institutions of higher learning. It is interesting to note that at the Big Ten Institutions and the University of Chicago, the total physical space currently acquired for research and graduate programs is far greater than that required for undergraduate academic needs. Moreover, the priority on expansion of research activity space is even greater than that required for housing the explosive enrollments at the undergraduate level. The problem is compounded by the fact that growth needs in research are quite unpredictable and that the emphasis on particular areas of research may change rapidly depending upon world conditions, new findings, or many other factors. As a consequence, the development of long range physical plans for housing research activities is nebulous at best. It would appear safe to assume that in the foreseeable future such programs will continue to expand and, indeed, expand at an accelerated rate on all academic fronts.

The most significant factor that generates such expansion is the continued growth of support of research programs by the federal government. There is no reason to assume that such programs will be diminished, but, on the contrary, in all probability they will be increased in scope in the future.

At the present time government agencies on the state and municipal levels are continually looking toward the educational institutions for research aid and community service activities, and these programs of long and short duration create need for physical facilities.

Moreover, the many private foundations have made financing available in numerous fields of research and academic programs, and such institutions have been established to promote expansion of knowledge for an indefinite period of time.

Finally, private grants have been made available by industry, trade, and professional organizations, and philanthropic individuals to further the course of research and education.

In short, aside from the normal capital financing of research programs, there are numerous sources of funds available for sponsoring new programs and for supporting and developing those in existence.

In general, however, research funds are allocated for staff, salaries, equipment, and the special requirements of the program involved. With few exceptions funds for the construction of space are not available unless a long term program is contemplated, and even in such cases, the complications involved in construction of space may create severe handicaps in the initiation of productive research.

In the case of the short term grant program, the cost involved in the construction of space is likely to be heavy in relation to the over-all budget, and as a consequence, the responsibility of providing such space falls upon the institution seeking the grant. The obvious end result is that those institutions having such space available are the most likely to receive outside financial assistance.

It is apparent, therefore, that if an institution is faced with the problem of expanding research activity and the solicitation of funds from sources other than from normal financing channels, it must be in a position to provide physical facilities if it expects to receive its proportionate share of grant programs.

The fact that such space may, or may not, be made available not only affects the disposition of the funding agency, but, of course, can have serious impact on the morale, procurement, and retention of the staff members involved. Since the staff member is the keystone, and most expensive factor in the research activity, this consideration cannot be treated lightly.

(b) Specific Needs

It has been pointed out that the programs of short term nature are highly unpredictable in terms of initiation, space need, duration, and substance. Emphasis in a particular area may change radically with new findings. Success or failure in any facet of the program may dictate an entirely new direction. At the same time, new developments in other fields may significantly affect the importance or the scope of the program involved.

Moreover, the tremendous variety of programs which are involved necessarily require entirely different space requirements as well as varying equipment and staff.

The type of space required for the short term program must be adaptable to a variety of uses, and must be readily converted for other use on short notice. Therefore the specific needs require that the physical space provided should be of a type that can house laboratories of a variety of types, shop space, office space, instructional space, storage, etc. However, such space need not be elaborate in finish or in construction.

It should be emphasized that the building or buildings housing the program represent a small part of the expenditure involved. The money involved in time and salaries of staff together with the oftentimes elaborate research equipment far outweighs the expense of building or otherwise providing space for the activity. Indeed, where warranted such space might be considered expendable, the structure representing only a temporary housing of essential personnel and equipment.

ALTERNATIVE SOLUTIONS TO SPACE PROBLEM

Several alternative solutions to the provision of space for short term grant programs are possible. These solutions depend upon many factors: the required use, the organizational control of allocation and administration, the campus physical plan, available locations, financing, etc. However, in general, the following types of space are considered as a partial or ultimate solution to the need:

1) Utilization of existing space
2) Addition to existing space
3) Purchase of existing space
4) Leasing of existing space
5) Construction of new space (owned or leased)
6) A combination of any of the above.

(a) Utilization of Existing Space

The most obvious solution for space for short term grant programs is the use of existing space. Ordinarily such space, if available, is closely related to other academic or research space and oftentimes this proximity can be of benefit to the program in terms of staff convenience, exchange of ideas, and dual use of equipment and certain facilities. If existing space in a desirable location is available, this solution is highly desirable.

Unfortunately, it cannot be a practical, permanent solution in most cases. First, existing space is usually at a premium and is intensively used for current programs. Indeed, it is a rare situation where any existing space is available for new or expanding programs and the use of such space ordinarily infers the abandonment or relocation of the programs currently utilizing the physical facility.

Second, space, if available, is likely to be poorly located with respect to the program in short or long range development. It is extremely unlikely that available existing space is properly located with respect to the function it is to serve.

Third, existing space is likely to be much more strategically used for academic programs. Existing space usually infers "on campus" space and as such becomes too valuable in terms of location for the short term grant program.

Fourth, it is not likely that existing space can answer the needs of flexibility which are so highly desirable for the short term grant program use.

Fifth, the existing space may be too valuable in terms of the construction cost. Most existing space is permanent in nature and as a consequence is apt to be more costly space than warranted. Moreover, the cost of remodeling such space is apt to be exorbitant.

Finally, it is rare that existing available space can be readily expanded if required, and as a consequence programs using such space might be jeopardized in the total development.

In short, if unlimited existing space of a flexible nature were available in locations related to disciplines of close interest, and if such space use did not jeopardize expansion of programs more directly related to the academic area, then the use of such existing space for short term grant programs would be highly desirable. Unfortunately, such ideal conditions are rare and as a consequence the use of existing space is feasible only in limited cases.

(b) Addition to Existing Space

New construction in terms of additions to existing space provides a second alternative to solving the need for short term grant programs. Such additions would provide facilities well located functionally to related academic disciplines.

Moreover, the space could be designed for flexibility and wherever possible, for expansion beyond current need. Again, if the conditions warrant, such a solution would appear highly desirable, particularly from the academic point of view.

On the other hand, there are inherent disadvantages to this solution. Additions to existing structures are generally quite costly as compared to new construction. Extensions of utility systems, conformance to existing designs, permanent type construction, and the plan compromises often incurred in such structures all contribute to the cost of facilities of this type.

In this solution as well as in the use of existing space, it is very probable that the additional space added might be better used for academic needs requiring more centralized locations on the campus or a closer relationship with discipline originally housed in the existing structure.

In summary, if expansion has been planned and if such extensions do not inhibit expansion of more closely academic oriented programs, the use of new structures as additions to existing ones may be a sound solution for short term grant programs. It should be kept in mind, however, that such a solution should be considered carefully in the total development of grant programs of various disciplines in view of possible changes in such programs. A building addition which might admirably suit one such program might be badly located for a priority program which might follow the original. A fixed facility of this type can only be a partial answer to the over-all problem.

(c) Purchase of Existing Space

A very common answer to the space need for short term grant programs is through the purchase of existing structures. This method of obtaining space usually involves the acquisition of residences or other buildings located near the campus proper. Such purchases not only achieve the purpose of providing temporary space for the required program but also serve to increase the overall scope of the physical plant and provide necessary expansion land for more permanent academic buildings, parking or other required services. Generally, the properties purchased are not as expensive as new construction, are considered expendable, and can serve many programs quite adequately over a few years' time.

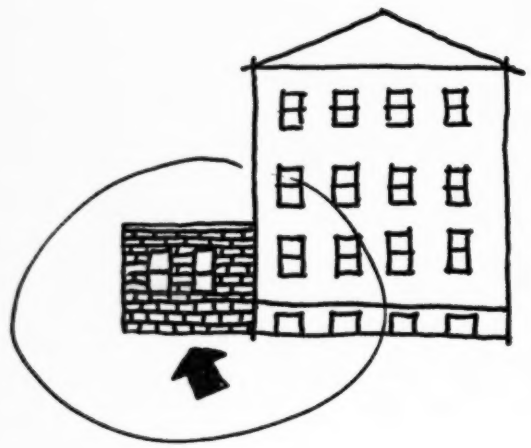
The disadvantage incurred in such an acquisition program for this purpose lies largely in the character of the space provided. Usually older houses, commercial buildings, or other buildings available at a reasonable price tend to be antiquated in structure and poorly planned for use other than for offices remodeling costs oftentimes offset the original attractive acquisition costs.

Further, the locations of such properties cannot usually be predetermined in terms of the functional aspects of the programs to be housed. In many instances, the acquired properties, almost always peripheral, may be widely scattered and poorly related to the disciplines affected.

In some cases there is local resistance to such acquisitions, sometimes involving condemnation proceedings. The resulting poor public relations may be a source of embarrassment to the institution.

Finally, there is virtually no flexibility or long range expansion possibility in this method of acquiring space. Such facilities are generally worthless for laboratory space unless a large investment in remodeling is considered, and the chance of reuse of such space would appear remote if major remodeling is required.

The acquisition of existing structures is an excellent expedient to solve the space problem for certain short term programs, but these methods cannot be considered as the best over-all solution due to the problems and time incurred in such



acquisitions and the comparatively limite
that such space can provide.

(d) Leasing of Existing Space

Probably one of the most obvious answ
the temporary space problem is throug
simple expedient of leasing space on or ne
campus.

This alternative has the distinct adva
of eliminating capital expenditure and the
operating funds to acquire space. Leases
arranged to conform to the duration of
programs, so that on termination of the pr
there is no problem of a large unam
investment.

The disadvantages of this solution var
individual situations. Oftentimes, such sp
reasonable proximity is not available. I
space is available the rental market may
too high for the use for which it is intende

This alternative also has the disadvan
acquired private structures in that such s
usually designed for other purposes and m
tions to the space for use by the grant pr
may involve extensive remodeling costs wh
either reflected in the rentals or are assu
the institution. Clearly, if a large expens
curred by the institution in such remodeli
advantage of a comparatively short tern
is lost.

In summary, then, the immediate adva
of such an alternative appear favorable a
deed, for certain programs where the s
usable with minor adjustment, it is an e
solution. But, this solution cannot hope to
the functional relationship requirements
of the lack of option of location, and at b
offer only a partial answer.

(e) Construction of New Space

It would appear that construction
space for short term grant programs is

desirable answer, assuming that the location of such space suits the needs of the programs and conforms to an over-all campus development plan. New construction allows for flexibility of design and function, opportunity for expansion and control over finishes, costs, utility system, etc.

There are two ways such construction can be financed. The first is through capital expenditure on the part of the institution. The second is through a lease-back arrangement wherein the building is constructed by other sources of funds and a lease arrangement to the institution is made. The choice of financing, of course, is based entirely on the individual situations and the policies of the institutions involved, although the lease-back arrangement can be advantageous if a reasonable rental structure is established.

This is particularly true, in the event that the program funds include cost of rent as part of the project expense. This is the case in some programs where cost of new construction is not an allowed expenditure. Some publicly supported programs provide, at least in part, capital funds for construction or remodeling. Clearly the type of funding dictates the ultimate choice of space, whether remodeled or new construction.

The disadvantages of new construction for short term grant programs lie largely in the fact that new construction is difficult to amortize over a short period, and it is difficult to construct a new building of reasonable standards for a short life span. Therefore, the useful life of the new building is of prime consideration.

(f) A Combination of Alternatives

It is difficult to find one solution that fits all contingencies. As a consequence, it is probable that most institutions might be forced, at least on a temporary basis, to adopt a combination of the above alternatives to meet its needs.

At the same time, every effort should be made to establish a general policy that could apply to most and even eventually all future short term grant programs' space requirements. The only way of accomplishing this would appear to be to approach the problem as a specific all-university problem and plan the solution in the same manner as the development of a campus plan or the plan of an individual building.

ORGANIZATIONAL ADMINISTRATIVE FRAMEWORK

It is not sufficient to say that the solution to the problem of providing space for short term grant programs lies solely in the construction of new buildings.

Self-evident as this may be, the immediate questions of space criteria, building types, locations, and method of financing are raised. But even before these vital criteria can be studied, the question of administrative control must be considered. Policy concerning such space, its allocation, and its expansion or construction is a strategic and even basic determinant of the type of building to be built and its location with respect to the campus as a whole.

The administrative policy selected is subject to the policy of the individual institution, but in general the following three basic organizational ideas are suggested:

(1) A university-wide research center with an over-all director or other administrative officer who would have responsibility for administrative control including the assignment of space. Administratively, this center might be distinct from other divisions of the Institution.

(2) A college or divisional center under the direction of the dean or divisional head. This center would be oriented more directly toward the

special area of i
or division.

(3) A depa
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control and space assignment
e difficult, and the research activi-
ly suffer from lack of interdisci-
ge of ideas and common use of

y, it is important that a definitive
framework be determined if a
physical space planning is to be
he short term grant programs.

PHYSICAL CHARACTERISTICS OF THE SPACE

Before any definitive solution to a space problem can be found, it is necessary to define the physical characteristics desired. In the case of space for the short term grant program, the following factors should be considered:

1. Economy

The facilities should be economical in an over-all sense. It is necessary to consider capital costs, and operation and maintenance costs as related to the amortization of the project over its projected life span.

In view of the comparatively short term use, it is clear that such building space should be provided for less money than the equivalent amount of permanent academic space.

2. Flexibility

Since the space must be able to accommodate a variety of programs and be relinquished upon termination of a single grant term project, it is essential that maximum flexibility be provided. This not only means flexibility in terms of partition remodeling, but also in the distribution of utilities and services.

3. Expandability

In view of the nature of the programs to be housed and their probable increase in scope, it would be short-sighted to plan the physical facilities without reasonable expansion possibilities.

4. Expendability

Depending upon several factors including the cost, location, and utilization of the space, the facilities might be considered expendable. This is particularly true in the case of so-called temporary buildings, old residences which have been acquired for the purpose, and new construction specifically designed for a projected life span of ten, fifteen, or twenty years. Generally operation and maintenance costs would be an important factor in the useful life expectancy of the facility. Another important consideration would be land cost and location, if such a location in time proves advantageous for other types of use in the basic academic program.

5. Proximity to Related Disciplines

Functionally, it is desirable to have space related to areas of similar interest. This would mean a reasonably close physical relationship in order to minimize staff travel and to take advantage of comparable facilities and equipment. Such physical proximity is subject to study of the individual situation, but it can be established either in an integrated development or separate facilities zoned in areas of interest.

6. Relationship to Campus Development Plan

In view of the fact that the space involved in the short term grant programs is necessarily an integral part of the campus as a whole, it is important that such facilities do not conflict with over-all planning policy. The location of such space, therefore, should not only consider the functional considerations, but should also consider the long range development of other programs in order to avoid conflicts in future developments or expansion.

7. Aesthetics

The expenditure of funds for capital improvements by any institution, either public or private, carries with it an obligation to consider the visual aspects as well as the economic and functional.

It is essential, that the campus, the academic buildings, and the ancillary and supporting facilities express a sense of order and provide an environment which is appropriate to and expressive of the learning process. No building design,

whether of permanent or temporary type should ignore this principle. Therefore, in spite of the economy desired in the short term grant program space, it is most important to consider the effect of its appearance on the campus and to the users.

SITE LOCATION

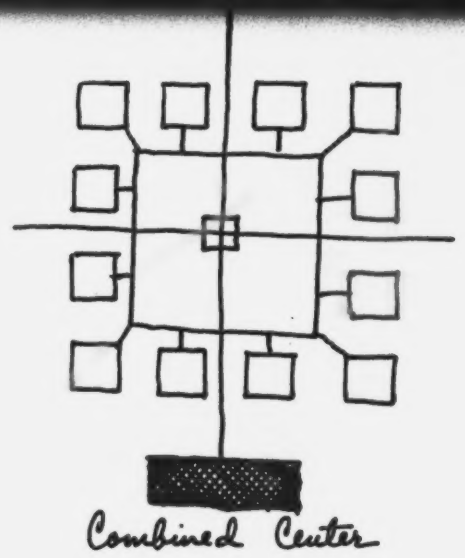
The location of physical facilities for the short term grant programs is subject to many variables, and each institution must adapt the location of its facilities to its administrative facility, its campus plan, the functional relationships desired, the locations available, and its methods of financing. In general, however, the following possibilities present themselves:

1. One or more major research centers located on a peripheral site

Such a possibility appears to have great advantage from a physical planning standpoint. By choosing a peripheral location, there would be little danger of blocking academic expansion of the main campus. In general, the land acquisition cost would be less than that on the campus or immediately adjacent. There would be little conflict in terms of aesthetics or the use of temporary structures. There would be greater flexibility in terms of building type, and finally, unlimited expansion could be provided without endangering expansion of other campus facilities.

Such a concept envisions a facility similar in character to an industrial park, consisting of a complex of buildings served by a central utilities distribution system, streets, drives, walks, etc. In effect it would constitute a separate campus having all of the disciplines engaged in research or community service gathered together with the potential economies of service, utilization of space, and the opportunity for interdisciplinary exchange of ideas. Financing of such a project might be on a basis of capital funding by the institution or by private enterprise on a lease-back arrangement.

The disadvantages of such a solution lie in the fact that the staff member who is involved in other academic activity would require travel time to and from the research center. Further, the separation of this research activity from the direct teaching activity might affect the teaching program. At the same time these handicaps might be overcome by proper scheduling of staff time and adequate transportation provisions.

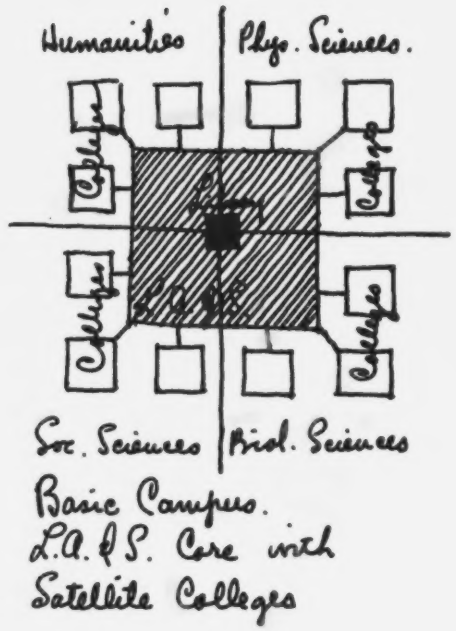


2. A divisional or college center located in an area adjacent to the general field of interest

This center would be located within the college zone, preferably on the periphery and would be related to more specific areas of interest. Such satellite centers could be constituted in a manner similar to the university-wide center, differing only in scale and functional location. Several such centers might be envisioned depending upon the academic organization of the individual institution.

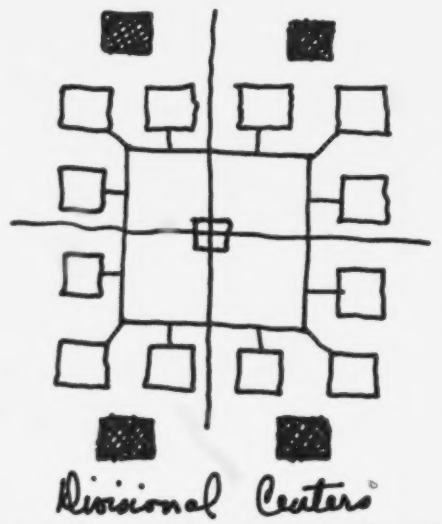
The advantage of such locations would be the reasonable proximity of activity for the staff members involved as well as the potential for some expansion and flexibility.

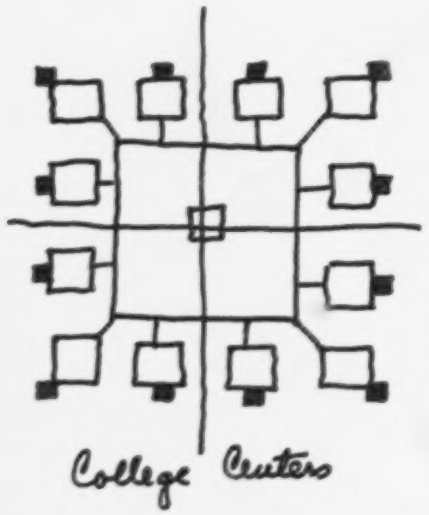
The disadvantage of this concept as opposed to the larger peripheral location lies in the fact that expansion might be limited, and the expansion of the academic programs might be affected by the location of the short term grant facilities. Further, a location adjacent, to or on the campus proper, is apt to be move expensive in terms of land cost and land use.

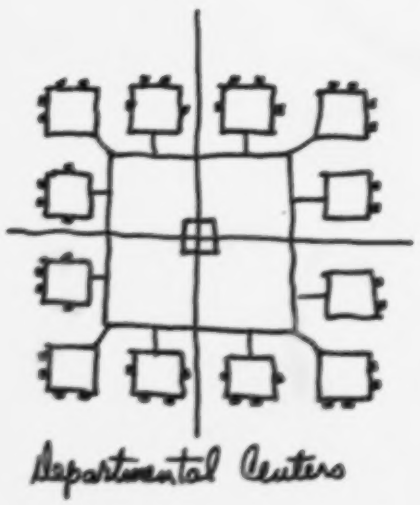


3. A departmental center within the area of academic interest

This center would be located adjacent to a departmental area and indeed might be incorporated in the same structure in certain instances.







The advantages to such a campus location lie in the staff convenience and the close physical relationship to teaching in the area of activity.

The disadvantages are the comparative lack of flexibility for other uses, the lack of expandability, and the use of valuable campus area which might be desperately needed in the future for activities other than research.

4. Spot locations on the campus and in peripheral areas

In many instances it is an advantage to an institution to be able to acquire, through purchase or lease, properties on or near the campus which might be strategic in terms of use for *general* campus expansion. Such facilities can be used to advantage in some cases for the short term grant programs even on the assumption that they will be later razed for academic expansion.

Although such locations are apt to be "spotty" in terms of desirable locations for the grant activity, it is possible to zone them in areas of disciplinary interest in order to relate them to academic functions nearby.

The disadvantage of such locations are that flexibility and expandability can be limited, remodeling costs are often high and such space is oftentimes inadequate and a potential handicap to the success of the program.

However, expediency may dictate such locations. If a longer range solution is anticipated, based on the assumptions that such properties will be ultimately used in the academic expansion program, the economy of such a solution may well outweigh any temporary disadvantages.

In general, the location of space for the short term grant program and indeed for other research activity is more desirable on a peripheral location. In most institutions land in the central part of the campus is at a premium in terms of the academic need as opposed to the research need. Therefore, careful consideration should be made before any such area is pre-empted in view of long range campus expansion.

In the case of most institutions, expansion needs dictate a property acquisition program in adjacent and peripheral areas in order to enlarge the campus core over a long range period. The use of such properties for short term programs might prove advantageous to the program and a reasonable justification for acquisition earlier than otherwise contemplated. A twofold purpose then can be achieved. If this concept is followed, however, priority should be given to the long range academic campus expansion as opposed to the short term program. The interim usage of the space should be considered only as a resultant benefit of the longer term expansion.

Usually the acquisition of such properties in peripheral areas involves small parcels which are acquired whenever the opportunity arises. The use of such parcels in small increments should be carefully considered in the long range view, and the existing or new structure constructed on such a location should be evaluated in terms of its cost and life span. An existing or new structure on such a site might well jeopardize the construction of a major academic facility when other adjacent properties are acquired.

In summary, the location of the facility for the short term grant program should not be considered as an individual solution to meet expediency but on the contrary, should be a part of a long range plan integrated into the campus activity and physical expansion program. Utility extension plans should be considered in every evaluation.

ALTERNATIVE BUILDING TYPES

In the event of the use of existing space either in present academic buildings, acquired, or leased space, little comment can be made except in terms of generalization. Remodeling is almost always mandatory in such cases and such remodeling or alteration is subject to the characteristics of the existing structure.

Therefore, discussion of building types is here limited to new structures designed or adapted for the specific purpose of housing the short term grant program. The choice of building type is based on considerations of location, function, financing and the satisfying of desirable characteristics of the space needed.

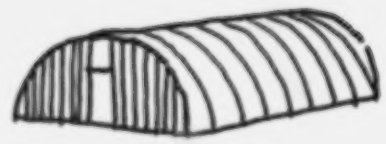
In evaluating the type of structure to be selected, it is important to recognize the fact that the exterior shell consisting of walls, floor and roof, although providing enclosed space, do not give the whole answer for providing usuable space.

The structural elements constituting the enclosure reflect only a portion of the costs of the usable space. Heating, air conditioning and controls, lighting, partitioning, plumbing, laboratory utilities, electrical systems, and equipment constitute the major costs involved. Therefore, in describing possible building types, these building elements must be always kept in mind. The type of building selected may be dictated by the necessary interior requirements, and the provision of such by the grant program or others, rather than by the apparent economy of the building shell.

Considering the total usable structure, certain building types designed for the purpose of short term grant programs are evaluated and listed as follows:

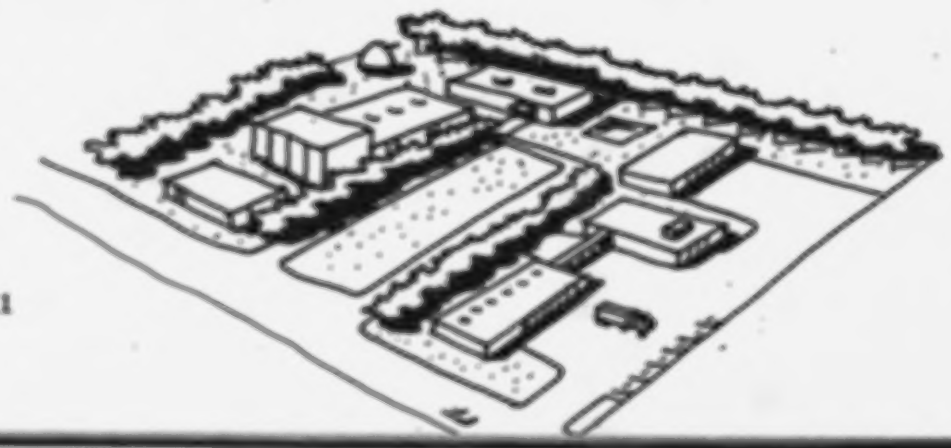
1. The pre-fabricated structure

When a request for space for an interim program of research or academic activity is advanced, the common concept of such space in the mind of the staff member or the physical plant is in terms of a building of temporary nature usually of the pre-fabricated type. This concept is ordinarily generated from the fact that the prime desire is for "space", not frills. There is little time to wait for building plans and the necessary red tape required in the usual channels of campus construction. Further, since the space is to be used on a temporary basis only, it would seem only appropriate to erect a temporary building, the cost of which would be written off in a short period of time.



As a consequence of these arguments, the use of such structures for grant programs and other expedient activities is prevalent and in many cases justifiable and appropriate. However, it is important to evaluate this type of structure objectively before a sound decision can be reached.

There are many types of such structures on the market today. They are provided in a variety of materials and structural systems. If such a building is contemplated, it is well for the potential user to evaluate the several types available on a comparable basis in terms of the structure, side walls, floor, finishes, and utilities to be furnished. This can generally be done through local distributors who are franchised to sell the package structure. The actual erection of the building may not be necessarily provided. It is important, therefore, that all facets be investigated, because at



first glance the building cost quoted may seem to be extremely low, but with consideration of all the building factors involved, the structure may prove more expensive than ordinary construction.

In general, the pre-fabricated structures, provide for a shell only. The cost of such a shell is, of course, proportionately low and the variation in cost depends largely upon the type of side wall material, the floor slab and other finishes. In most cases, no utilities, interior partitioning, lighting, heating or air conditioning are included.

Although the structures vary in design and construction, most have the same general advantages and disadvantages for use for short term grant programs.

The buildings generally are rectangular in plan, the design based on a structural module developed by the manufacturer. Ordinarily such a structure provides good clear span space which can in most cases be extended in the long dimension. Where the use involves only open space for shops, offices, storage, or laboratories, this type of structure might be a satisfactory choice.

The advantages of such structures lie not only in a comparatively inexpensive shell structure with very usable open areas, but also in the fact that they can be purchased at a fixed cost and erected much more quickly than ordinary construction. These advantages might weigh heavily in a situation where staff time is vital and the rapid initiation of a program outweighs other considerations.

The disadvantages of such structures are again generalized and depend to some degree on the type to be considered. First, there is very little flexibility in the basic plan of most of the structures. Although they can be extended in length, they cannot generally be extended in width, except by the addition of a new and similar structure. Further, the general structures do not adapt themselves well to interior partitioning unless a false ceiling is installed. The interior cubic space is generally of such a nature that any lighting, piping or other utilities including ductwork must be exposed. Although this may not prove disadvantageous for all uses, it should nevertheless be considered.

The finishes are for the most part crude and not easy to maintain. Finishes of steel, aluminum and asbestos board are typical and if insulation is provided, additional costs are incurred. As a consequence heating and air conditioning loads may be heavy and expensive.

The use of windows is limited in the design of most of the structures. Although this may not be a handicap to many programs, the effect on staff morale may be unfortunate.

Finally, the structures, with some exception, are aesthetically unpleasing. Part of this disadvantage lies in the traditional reaction that an inexpensive structure is necessarily an ugly one, and the fact that the pre-fab structure is generally associated with a service yard or other purely utilitarian area. The fact remains, the general reaction is that they are unsightly and their appearance in a prominent location almost always generates adverse reaction. Again this particular criticism might be met by careful consideration of the exterior materials, the appropriate siting of the structure, or by a peripheral grouping away from the campus proper.

In summary, the pre-fabricated building can be used to advantage in cases where clear space is basic to the function. But where many utilities or finishes are required, the apparent low initial cost of the shell may not be a big factor in the over-all cost of the building either in initial cost or in operation and maintenance.

2. The industrial type structure

Assuming that one or more research centers is the administrative solution for providing space for the short term grant program and other research activity, the use of industrial type buildings might be considered. Indeed, at Ohio State University, a factory type building has been purchased for space for special projects.

Assuming that such a structure designed for the specific purpose would be located in a peripheral location, the land costs should be comparatively low. Therefore, a one-story structure would appear to be the most desirable in terms of adaptability and expandability.

Such a structure should be designed on a structural module that would be appropriate for laboratory layouts. Presumably, such a structural bay would also be adaptable to other uses as well. The economy of such a structural module should be studied with the type of structural system used, but assuming steel columns and bar joist construction, bays from 25'-30' would be economical and adaptable to most uses.

Flexibility could be achieved by providing for movable partitions and a basic utility grid system that would provide connections for laboratory or other equipment. The basic bay unit, serving as the module could be added in increments of expansion as the need would arise. The materials could be readily stockpiled so that construction could proceed without planning time or ordinary construction delays.

Assuming that peripheral land were not available, or that staff pressure would insist on a more centralized location, this type of structure might not be feasible in terms of land costs. For example if adjacent or "on campus" land costs are equivalent to $4 to $6 per square foot and the assumed building cost is $10 to $12 per square foot (depending upon utilities), it would not be economical to plan a one-story building. The land cost in this case should represent about 10% of the building cost in which case, a multi-story building of four or more stories would be required to suit economical land use.

In this event the structural costs would rise accordingly due to heavier loads and necessary fireproofing. Moreover, such a building is not as readily altered in terms of utility distribution, and expansion could be more difficult.

In summary, the use of an industrial type structure in a peripheral location is an admirable solution to unpredictable space requirements. The space provided is readily adaptable to changing and expanding and contracting programs. It is economical to construct, can easily be extended, and can be aesthetically pleasing.

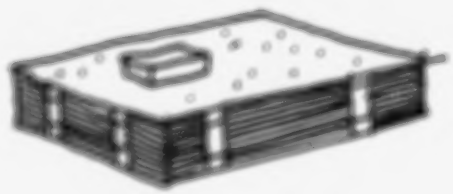
Such a structure erected in a location adjacent to or on the main campus might have serious disadvantages in terms of construction cost related to land cost, lack of flexibility and the possible blockage of academic expansion.

3. The modular building of varying size

Another type of building which might be used in the proposed location is a custom designed modular unit. The conception of this type of structure would vary with the individual institution, but the basic idea would involve a semi-pre-fabricated structural unit which could be stockpiled and easily and quickly erected on demand.

Conceivably such a building could incorporate conventional materials which would have the advantage of utilizing conventional labor, economies in quantity stockpiling, and uniformity of design.

The basic structure would again be based on an economical bay structure, 20' to 30' in span, depending upon individual conditions. Assuming one story construction, the use of standardized bar joist roof framing with an insulated roof, and lightweight concrete block side walls make for an



extremely economical shell. The floor slab would be conventional concrete construction.

Windows could be arranged in a modular pattern to allow for removal in event of expansion.

Such a basic building module can result in great flexibility. It can be readily expanded, it can be changed in ceiling height if desired, it can be treated on the exterior with alternate materials, and the flat roof construction is readily adaptable for interior partition placement.

Such a basic unit might have all of the advantages of the manufactured pre-fabricated structure and eliminate most of the disadvantages. It could be constructed in large or small increments, the initial and operating costs are low, and the appearance can be made pleasing.

However, depending upon the location, such a structure should be planned for expandability. In this connection, the costs, installation, and flexibility of all utility systems should be carefully studied.

Summary

In summary, the type of structure selected can be of many types, but a basic structural unit would appear advantageous from the standpoint of flexibility, economy, and expandability. In any type of structure selected, however, the introduction of utilities and interior amenities will prove to be more costly than the basic shell as every consideration should be weighed in providing for the total usable space, not merely the enclosing shell. Depending upon local conditions, a shell structure may be constructed, from $5 to $8 per square foot whereas the functional requirements in terms of heating, lighting, utilities, etc., may increase the cost from $6 to $12 per square foot in addition, depending upon requirements. Equipment costs are, of course, entirely variable.

THE EXPERIENCE AT THE UNIVERSITY OF ILLINOIS

a. The Need For Short Term Grant Space

Like other state supported institutions of comparable size and activity, the University of Illinois at Urbana is faced with the problems of inadequate space, expanding enrollments, and constantly expanding research.

In addition, there is a constant expansion of quasi-University agencies which make up a major function of the modern University in terms of public service in extension, in correlation of academic disciplines, and in government, labor and industrial relations.

The physical space required for enrollment expansion is reasonably predictable and a ten year development plan has been established to accommodate space requirements for the basic academic programs. However, it is realized that the problems of research expansion, the expansion of the quasi-University functions, and the constant increase of grant programs in all disciplines are more unpredictable over a ten year period. As a consequence, it is virtually impossible to establish a general physical development plan which can accommodate all of the variables which can be expected. In spite of this, an effort has been made by the academic staff and the administration to provide for expansion for the various research disciplines and the quasi-University agencies. Such expansion needs are based on normal predictions and calculated estimates of expanded activities related to over-all enrollment growth of the institution.

The increasing emphasis on grant programs has indicated that such predictions must be constantly revised upward with the result that no long range physical expansion needs can be accurately forecast.

Yet it was essential to the growth and development of the University that some plan be established to provide for the contingency of rapid and extensive development in the many areas of interest which might be affected by grant funds. Indeed, with the constant pressure of expanding enrollments and the numerous priorities imposed on state funds, it is more and more vital for the research activities to rely on sources other than normal financing. Consequently there is increased emphasis on procurement of such funds and the demands for space to house potential programs is steadily increasing.

The lack of the space to house such programs and the consequent potential loss of opportunity offered by outside grants has endangered existing programs and in some cases, created problems in terms of procurement and retention of key staff members.

Most of the space provided for such programs consists primarily of residential structures in the general campus area, or leased space when it becomes available. This solution sometimes involves high remodelling costs and oftentimes a temporary solution at best due to the priority of the expansion of major academic facilities which necessitates the razing of the buildings being used for temporary research programs or quasi-University functions.

A recent physical inventory of academic space revealed that research space, including laboratories and research offices, represented over thirty per cent of the total space requirements for the University. The new emphasis on short term grant programs and matching fund programs are showing every evidence of affecting an increase in this space-demand ratio.

At the same time it has become evident that the cost of space as compared to the value of the research is minor. In one specific case the budget for new temporary type space is $164,000, whereas the research grant to be housed in the space involves expenditures of $320,000 per year over a several year period.

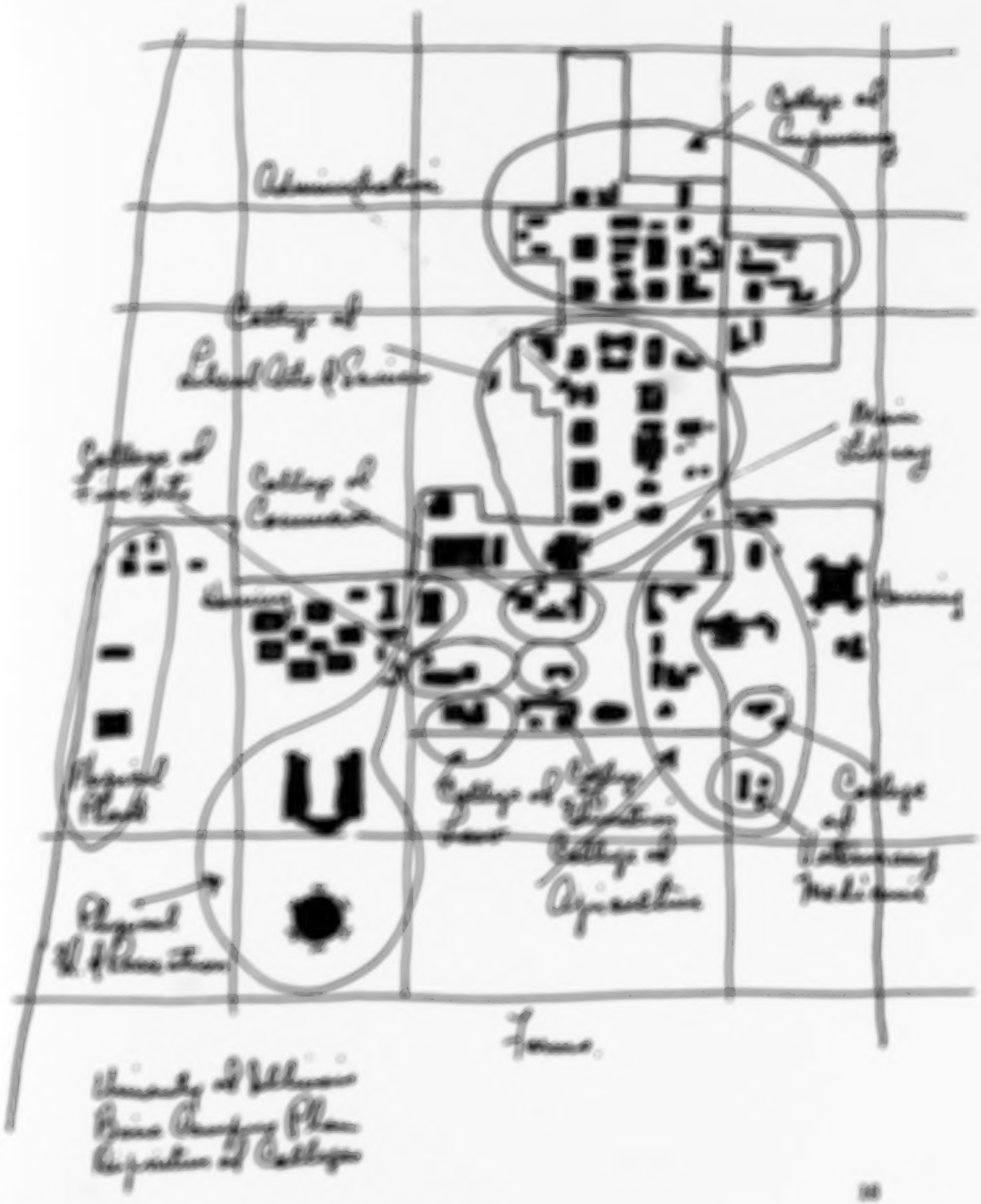
Realizing the seriousness of the situation, the University worked to find a long range solution to the problems of housing the unpredictable research and service programs. For the sake of identification, the study was called the "Surge Space Program," defining the actual need of the surging demand for non-academic space.

b. Site Location

The various requests for space involving the grant programs carried with them strong desires in terms of location. The staff members involved had the natural wish to have their research programs related to the basic academic sphere of interest involved. Moreover any distant location, they felt, would decrease the staff effectiveness and the over-all efficiency of the program.

Regardless of these strong desires, however, it was essential from the over-all planning standpoint that the location or locations of "surge space" be in no conflict with the general physical development plan. In spite of the importance of the programs conceived, the development of the physical facilities for the expanding academic programs took first priority.

The ten year development plan for the Urbana campus of the University of Illinois involves a central academic core of Liberal Arts and Sciences, surrounded in a satellite arrangement by the Colleges of Engineering, Commerce, Fine and Applied Arts, Education, Agriculture, Law, and Veterinary Medicine. In the development plan, each College is related to the Liberal Arts & Science College core as well as to one another in an appropriate relationship of student travel and



University of Alberta
Main Campus Plan
Expansion of Colleges

source offerings. Each College zone encompasses enough area for new construction to accommodate physical needs for the foreseeable future. Any encroachment in these areas for other activities might well jeopardize the physical development potential of that particular College.

Therefore, when the requests for space for grant programs also involved requests within the college areas, the possible conflict had to be resolved to the best interests of the University as a whole.

First, the concept of a total research center located in a peripheral area was investigated. The disadvantage in this solution lay in the fact that no large tract of land near the campus could be made available for the purpose, and acquisition of land in the surrounding areas would be prohibitive in cost. Moreover, the accumulated requests for space were too small to warrant a large investment in land, particularly when the land acquisition funds allocated to the University are limited and are generally used for academic expansion. Finally, the staff members indicated a reluctance to establishing their research activity too far removed from their fellow staff members or their teaching activities.

It was then decided to divide the campus into zones of interest and thus establish satellite surge building areas within such zones.

At the same time, a central zone consisting of the main academic campus was established within which no surge space of temporary nature could be constructed. This was done because it was felt that the central zone of the campus represented land and building area which was much more valuable for academic use, due to walking distances, proximity to the Main Library and the Memorial Student Union building.

The resulting general locations involved two zones for the College of Engineering, one for the

College of Liberal Arts and Sciences, one for the College of Fine and Applied Arts, Commerce and Education, one for the College of Agriculture, and one for the College of Veterinary Medicine.

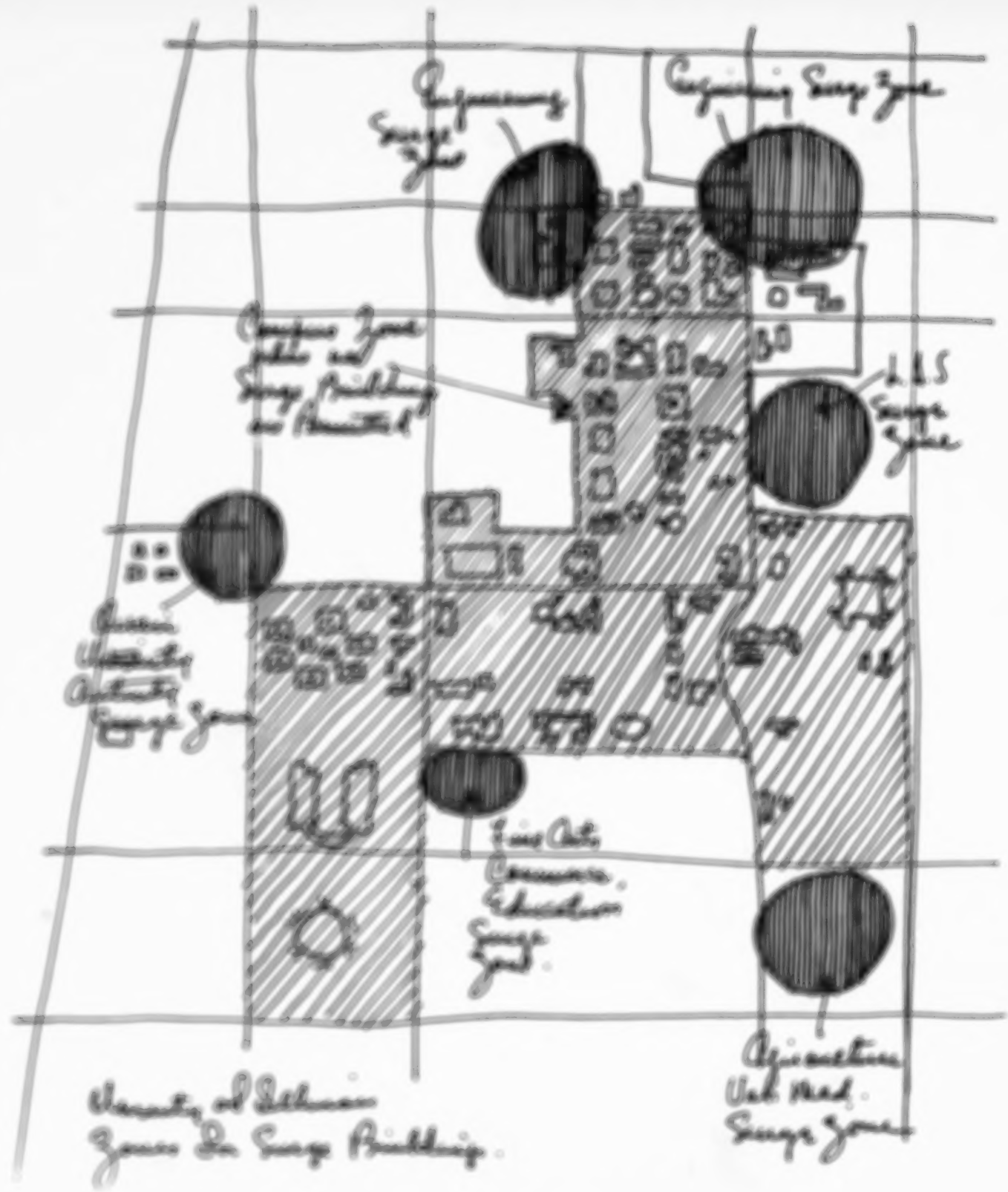
In view of the nature of the programs and of the probable nature of the buildings to house such programs, it was decided that the final locations of the specific space should be peripheral, that they should be so located as to avoid blockage of academic expansion for a ten year period, and that the building space should be considered as expendable after a ten year period.

With these criteria in mind, the individual areas were studied for specific sites and possible long range development of both the academic and surge programs. In general the sites allocated were presently owned by the University and were considered as long range expansion areas for the colleges concerned in that area. However, in no case was a site selected that would conflict with college programs in the foreseeable future.

After the tentative selection of each site, an analysis of utilities distribution to each site was made. Obviously, an extended utility system installed to serve only these buildings would be prohibitive in cost. Therefore, it was important that utility connections be provided within reasonable cost limitations.

Finally, the proposed sites were analyzed with respect to aesthetic considerations. In the event that the ultimate building solution would be of a pre-fabricated type, it was important to consider general reaction to such a building in a prominent location with respect to the campus as a whole.

Ultimately, sites were chosen which not only are reasonably convenient for the staff involved in the programs, but are also well chosen for utility distribution and ultimate expansion. They are located in peripheral areas which are not in conflict with immediate academic expansion.


Engineering Surge Zone
Engineering Surge Zone
Campus Zone Fine Arts Surge Building
I.A.S. Surge Zone
Veterinary Medicine Surge Zone
Fine Arts Commerce Education Surge Zone
Agriculture Utilities Surge Zone
University of Saskatchewan Future Surge Buildings

c. Administrative Control

The assignment of and the approval of a space request for a grant program at the University of Illinois rests with the Provost, who is Vice President for Academic Affairs. The decision may be based on the advice of the Dean of the Graduate College, who is also Chairman of the University Research Committee, and the Dean of the College within whose discipline the grant program falls. The space, having been assigned and occupied, is subject to reassignment by the office of the Provost, but in the event of the grant program, a given time period for assignment is made with the understanding that the space may be re-allocated upon the termination of the program. The assignment and control of such space is centralized in the offices of the University Administration. The Deans of the Colleges, although advisory, have no direct control over such space.

d. Physical Requirements

As may be expected, segments of space for grant programs at the University of Illinois have been varied and have involved a range of complexity from highly specialized laboratories to simple shop or office areas.

To meet the variety of demands and to permit flexibility and expandability, a study of building types was undertaken to determine an approach which might answer the requirements of most programs. It was thought that if a common answer could be found, then the components could be standardized. As a result, real savings in construction costs might be realized and at the same time, the buildings could be ordered like equipment and be erected from the standpoint in a very short time. Indeed, such a solution, if it could be found, appeared to have great advantage.

The basic physical requirements involved are:

1. Flexibility
2. Expandability
3. Economy in Initial and Operating Cost
4. Provision for Utilities
5. Provision for Ventilating and Air Conditioning
6. Aesthetic Appeal

e. Selection of Building Types

In view of the comparatively small sizes which were originally selected for the first building increments, and in view of the rather stringent requirements, the first type of building investigated was the pre-fabricated type. Several products of well known manufacturers were analyzed and cost estimates including erection costs were taken.

Due to the wide variation of internal requirements for different grant programs, no costs of utilities, equipment, or heating and ventilation were determined at this time. The purpose of the analysis was to select the most economical shell on the assumption that the extra services would be necessary on a comparable basis with any type of construction.

At the same time a conventional bearing block wall and steel bar joist building of similar size was investigated. Comparable specifications were drawn on this prototype building and the apparent, most desirable pre-fabricated building, and bond bids were taken by the same contractor. The result was that the more conventional type of shell building of concrete block and bar joist construction cost $2 per square foot less than the pre-fabricated building with comparable amenities. (See Appendix)

As a result of these studies and the actual bid prices, it was decided by the University to develop a prototype and build two such buildings to satisfy current requests. One such building involves office space primarily, the other involves a laboratory use.

The building prototype is based on a modular unit of 40'x40' with the exterior walls of bearing masonry and one center column making four 20'x20' bays. Window openings, or door openings, are provided in every bay. Each 1600 square foot module is self-contained with its own toilet facilities and heating and air conditioning system. Basic utilities are provided under the floor for attachment when needed.

The system provides for a broad range of flexibility and expandability. The original unit can be extended with additional basic modules in any direction depending on the use. The extension of the original building can be made by eliminating a door or window opening and adding another unit. Since each unit is self-contained in terms of heating, air conditioning and basic plumbing, the units may be considered to be an actual piece of equipment, the components of which can be duplicated and ordered as required.

Economies in construction were sought in the use of concrete block bearing walls, standard bar joist construction, unbrushed but painted interior surfaces, insulated exposed roof deck, and a grade beam foundation rather than typical footings. Piping is exposed as is necessary ductwork. The entire concept involves a building of expendable nature designed to provide usable space on short notice at an economical cost.

In order to achieve aesthetic acceptance on the campus, careful consideration has been given to the exterior color as well as the color of the exterior openings. Colors studied included a dark slate, a dark brown, and dark grey. Although the building would seem to be quite ordinary in appearance, the actual result is very acceptable and particularly so if landscape treatment is considered.

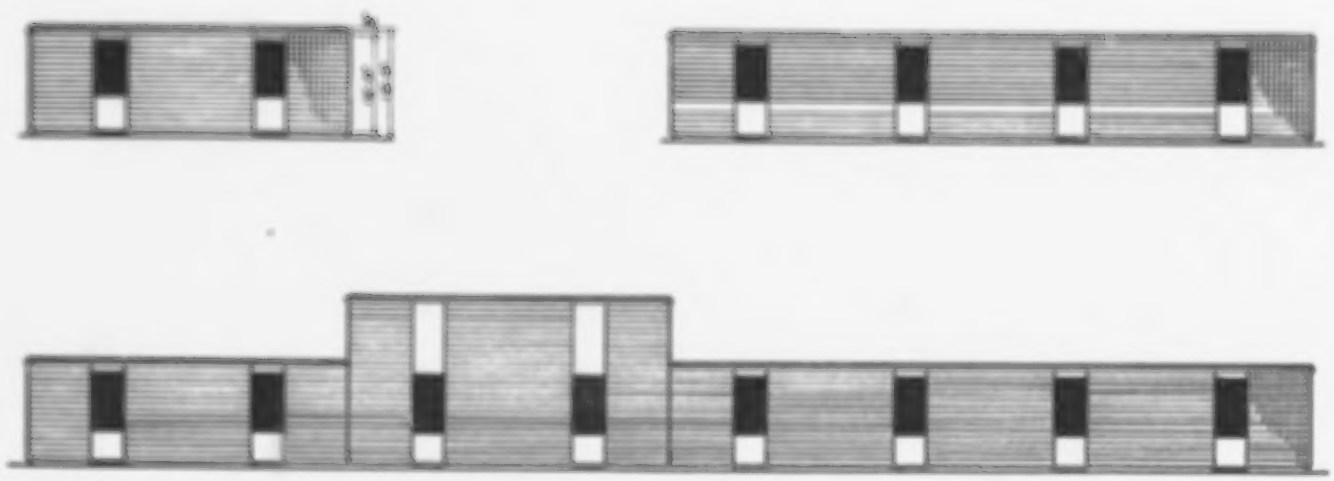
The illustrations indicate the basic module, the methods in which the module may be extended, the basic details, and the elevations showing what height variations may be made when required.

The experience at the University of Illinois is only in a preliminary stage. An analysis of the success of the first "surge" structure is now being made; it would appear that the general approach is a successful one.

However, it should be pointed out that no economies can be achieved if there is insistence on elaborate finishes, complicated utility systems and equipment, elaborate movable partitions and the like.

The first unit constructed at the University is perhaps somewhat elaborate in this respect. It is basically an office building with a number of partitions of a movable type, electrical utilities poured in the slab, a conventional foundation, and more than minimum ductwork because the partitions extend to the ceiling. It should not be considered as a prototype, therefore, but rather as an experimental building for study in economy and design. Therefore the cost analysis (See Appendix) should serve only as a guide and not as a typical or final answer.

In summary, the experience at the University is still in the early stages. An approach has been made and the problem recognized. Zones of need have been determined and general locations have been selected. In addition, the principles of expandability and expendability have been established. But it is recognized that much work remains to be done on the final design of a prototype structure and the necessary ramifications of flexible utility distribution.

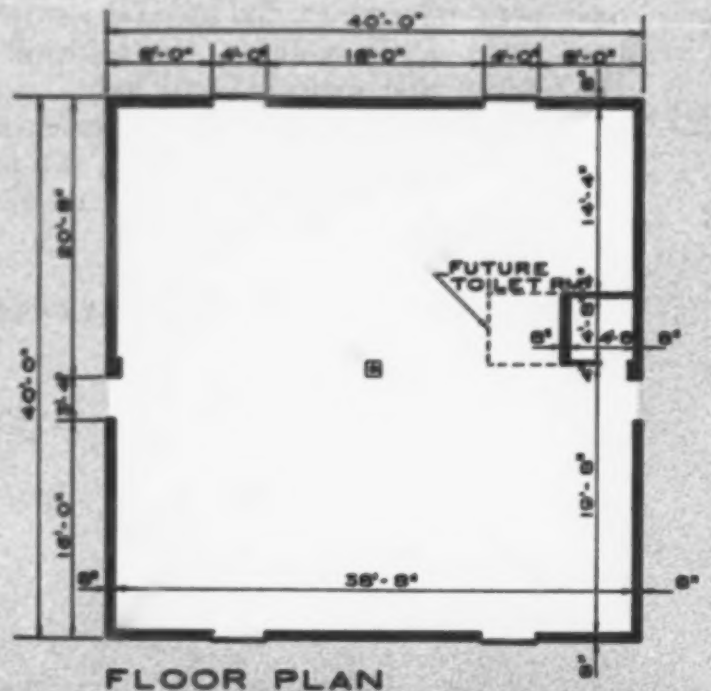


ELEVATIONS

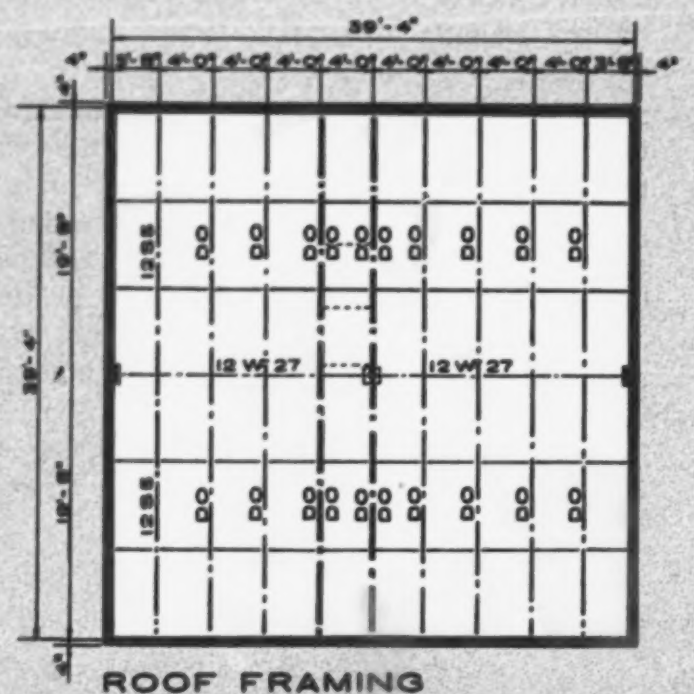
CONCLUSION

It is clear that the problem of providing space for short term grant programs is an important one. This monograph has aimed at pointing out some of the methods of achieving such space and in particular the attempts made to date at the University of Illinois. But it is recognized that there is no positive answer to fit all conditions and each institution must solve its own problem in the most applicable way.

However, it is believed that this report will help others to approach their problem with a wider perspective and to encourage ingenious solutions. Obviously, the research efforts to provide economical and usable space on short notice are only beginning, but if serious work to find a solution or solutions to such needs is not accelerated, many of our research programs may be seriously curtailed.



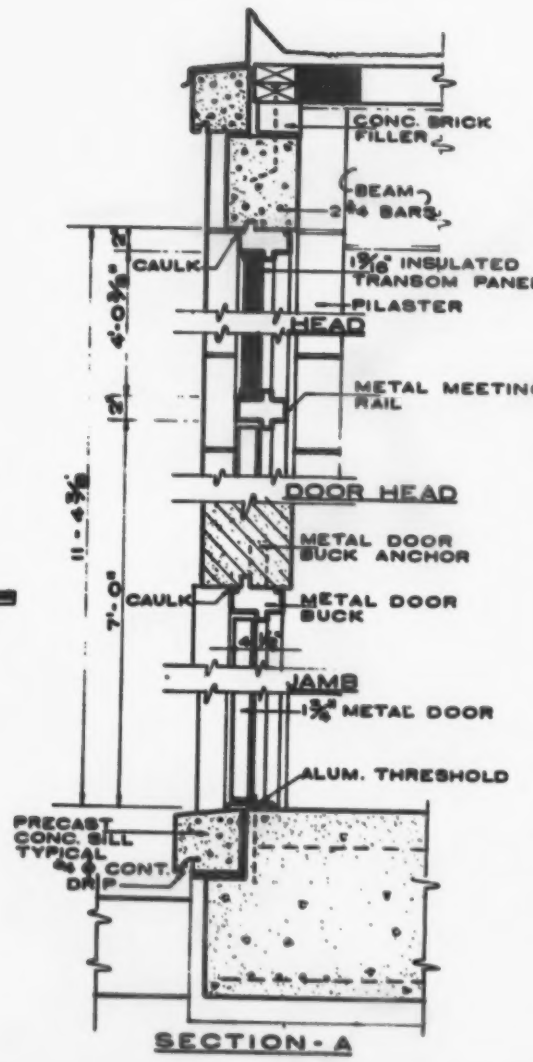
FLOOR PLAN



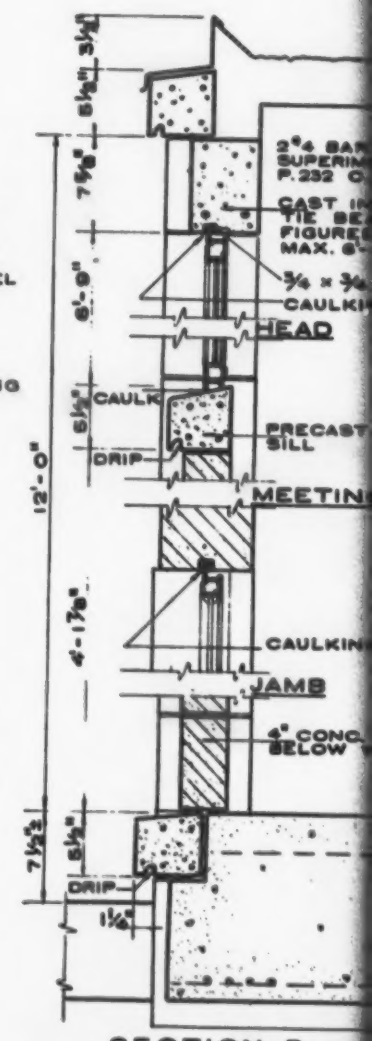
ROOF FRAMING

TYPICAL SECTIONS

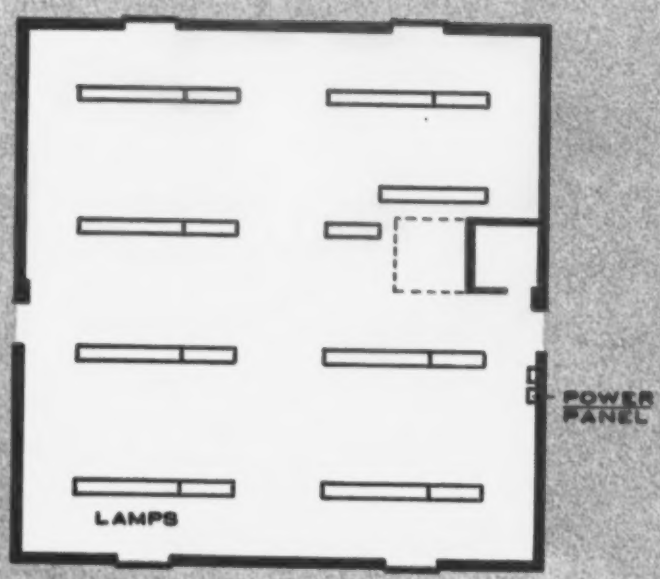
SCALE 1½" = 1'-0"



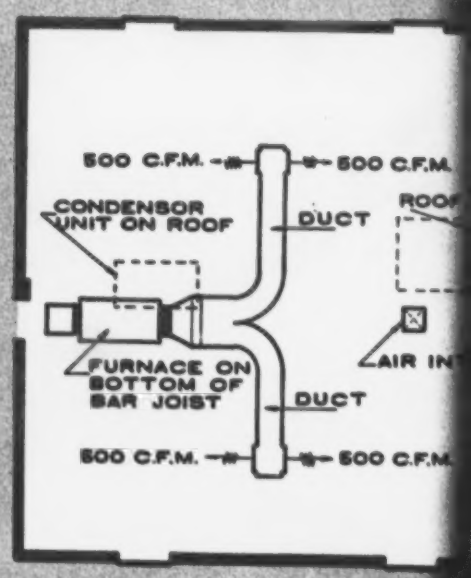
SECTION - A



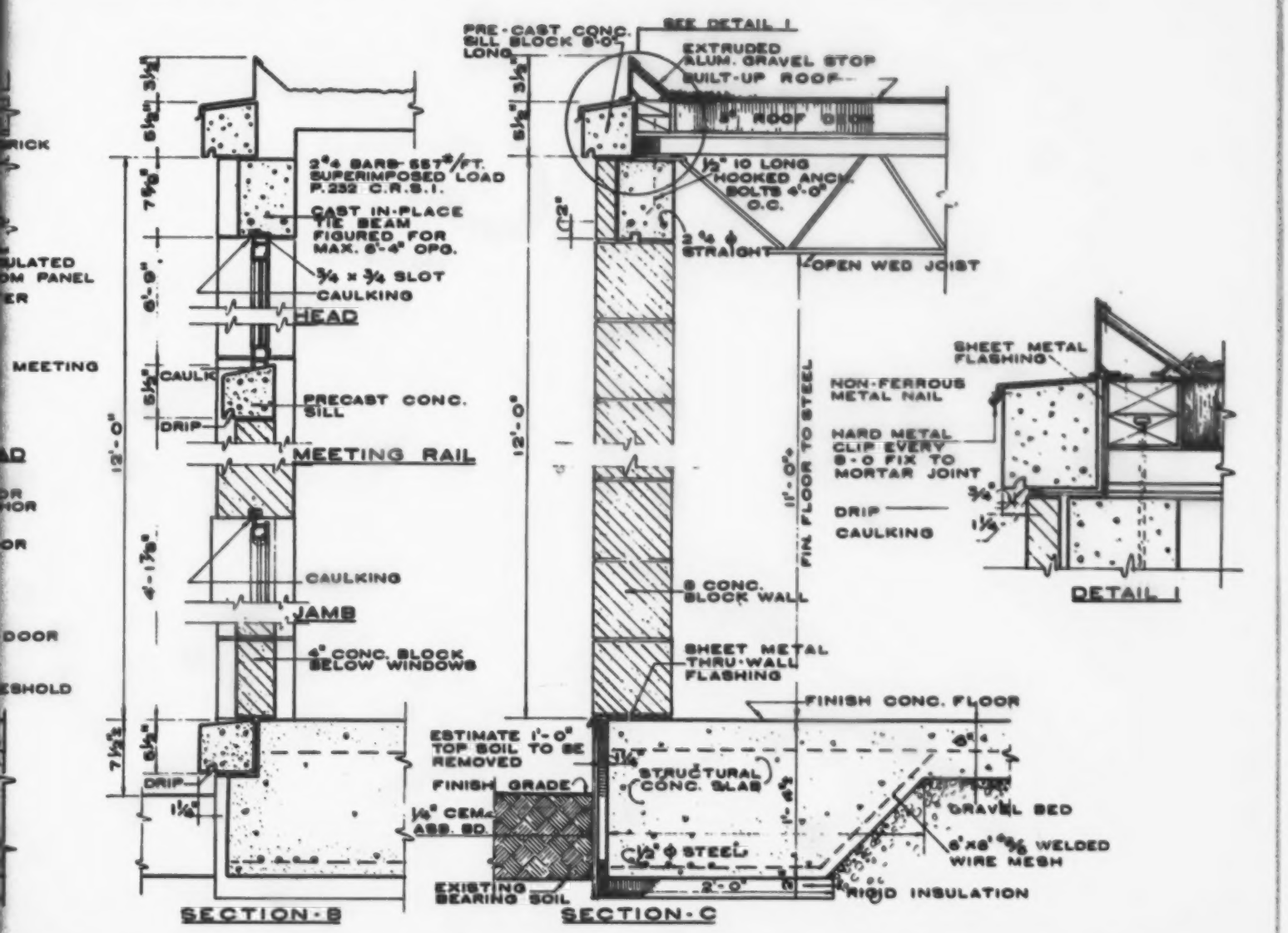
SECTION - B

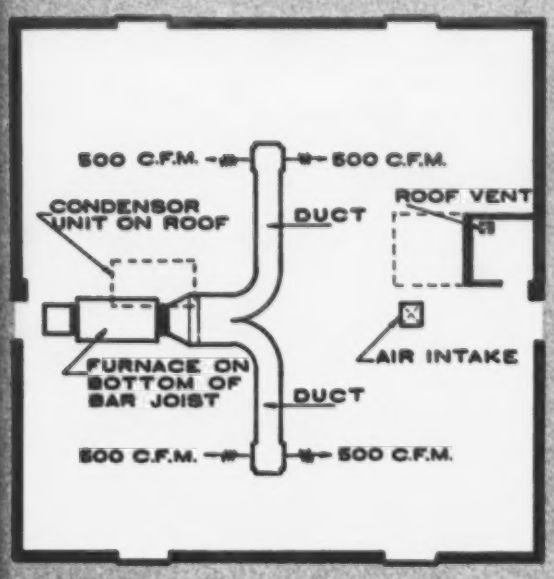


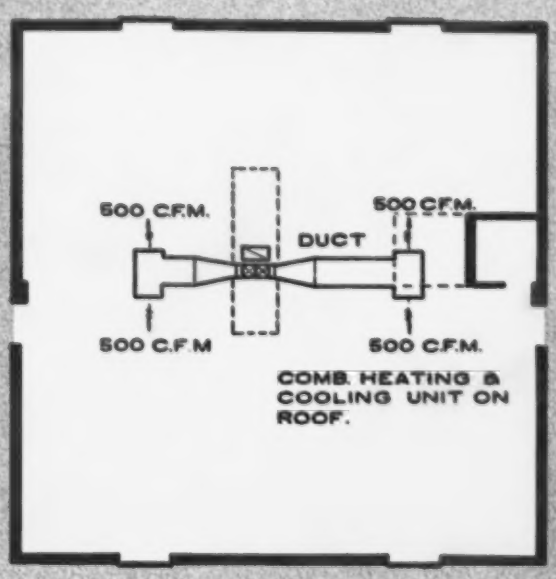
ELECTRICAL PLAN



HEAT

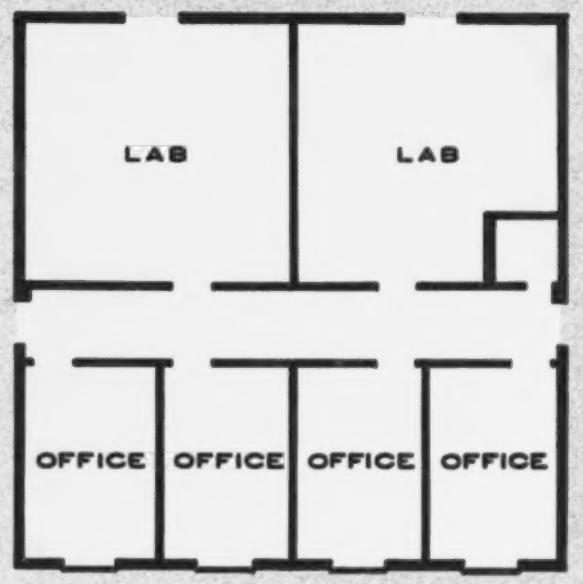


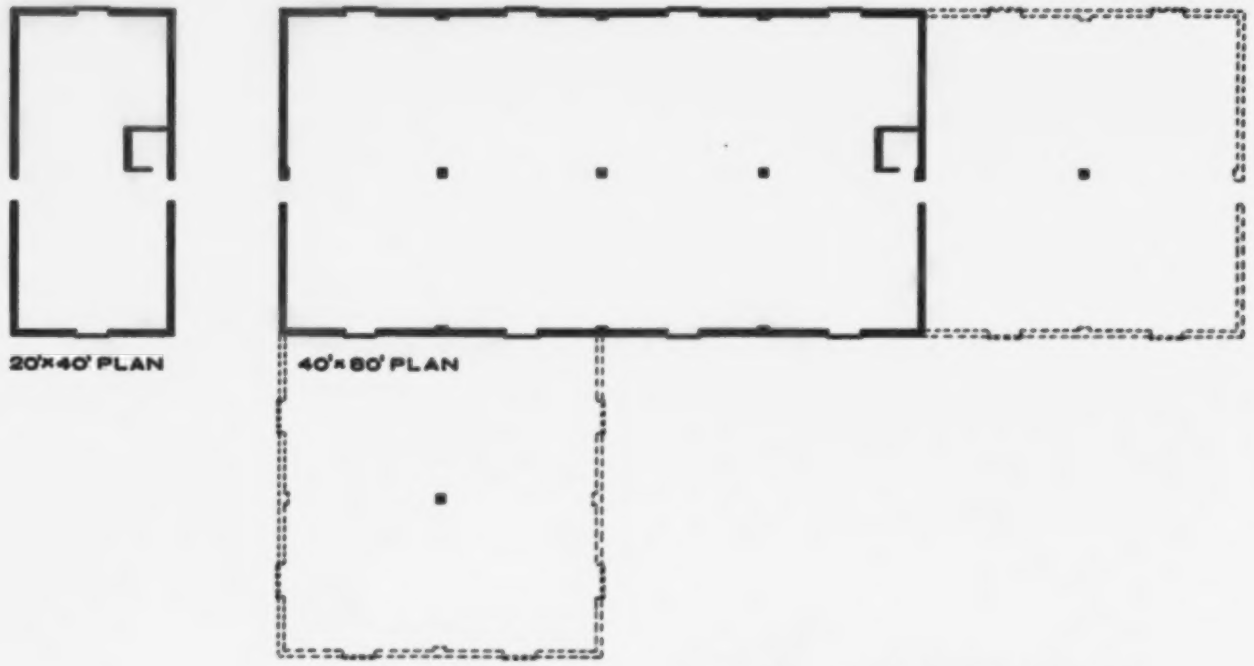




HEATING & AIR CONDITIONING

PLAN USES





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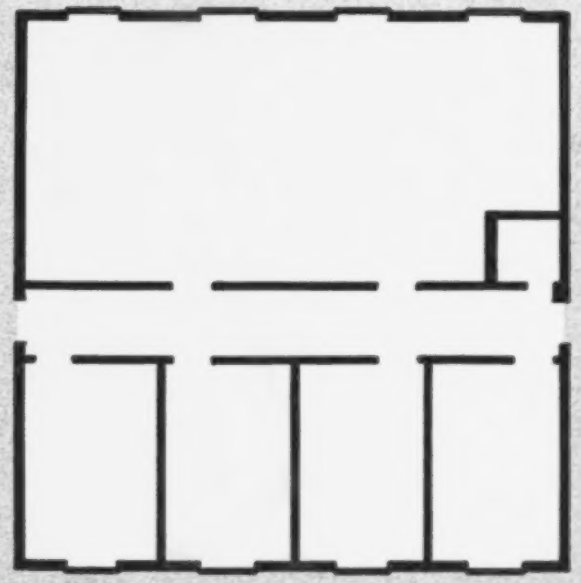

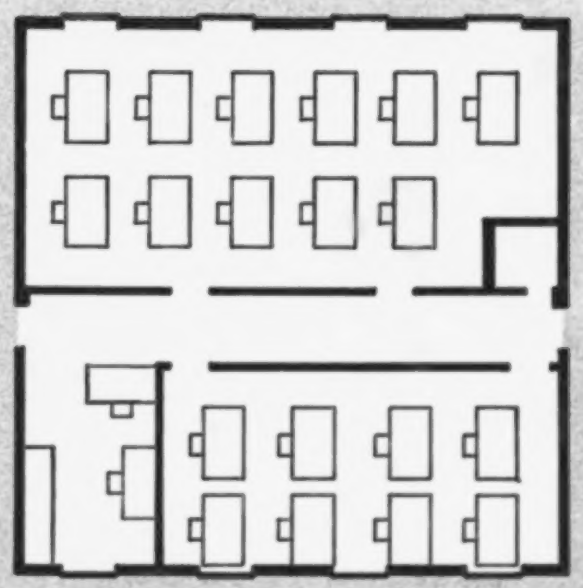

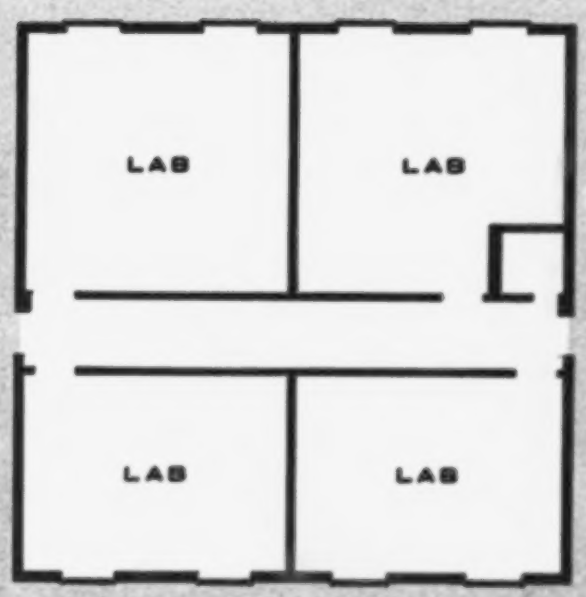

APPENDIX

The following constitutes the breakdown of costs for the first surge building built at the University of Illinois. It should be pointed out that costs depend on the interior partitioning, the type of mechanical systems, and the general functions to be used.

In the project described in this cost breakdown the function was largely office space with movable partitions, complete air-conditioning, and some furnished space. In the event that the building would be used as large open space the cost would be reduced accordingly. On the other hand laboratory space involving complex utility systems would increase the cost.

COST BREAKDOWN

SURGE BUILDING—UNIVERSITY OF ILLINOIS, URBANA

	Amount	%
GENERAL CONTRACT		
Site Preparation & Excavation	$ 546	1.9
Foundations	1,278	4.5
Concrete Floor Slab	2,483	8.8
Structural Steel and Bar Joists	2,057	7.3
Windows and Doors	1,416	5.0
Miscellaneous Metals	586	2.1
Rough Carpentry, Carpentry & Millwork	2,752	9.8
Finish Hardware	587	2.1
Sidewalks & Grading	290	1.0
Masonry	4,050	14.4
Roof Deck	1,950	7.0
Roofing and Sheet Metal	1,225	4.3
Movable Partitions	6,190	22.1
Floorcovering	712	2.5
Painting and Glazing	1,740	6.2
Bond	281	1.0
Subtotal	$28,143	100.0
HEATING AND VENTILATING		
Furnaces and Blowers	$ 1,175	13.2
Cooling Coils and Diffusers	695	7.8
Fittings	370	4.2
Sheet Metal Work	3,190	35.9
Condensing Units and Piping	2,447	27.6
Gas Piping and Miscellaneous	340	3.8
Controls	570	6.5
Bond	87	1.0
Subtotal	$ 8,874	100.0
ELECTRICAL Subtotal	$ 5,955	
Total	$42,972	
SUMMARY:		
General Contract	$28,143	65.5
Heating and Ventilating	8,874	20.7
Electrical	5,955	13.8
GRAND TOTAL	$42,972	100.0

Committee on Institutional Cooperation

This is a voluntary organization of the following eleven middle western universities: University of Chicago, University of Illinois, Indiana University, State University of Iowa, University of Michigan, Michigan State University, University of Minnesota, Northwestern University, The Ohio State University, Purdue University and The University of Wisconsin. Officially named the "Committee on Institutional Cooperation of the Council of Ten and the University of Chicago," the unit grew out of a series of informal meetings of the presidents of the universities and was formally constituted in 1957. The Committee is made up of one representative from each institution, appointed by his president. A small professional staff carries out the programs approved by the Committee.

The goal of the Committee is to improve educational and public services and research pursuits while minimizing costs by: (1) encouraging cooperative efforts among the eleven institutions, (2) identifying specialized areas of teaching and research in which cooperative arrangements may be desirable and (3) initiating cooperative activities in instruction and research, particularly in graduate areas, among the universities.

After the Committee was established, it requested and was awarded a grant from the Carnegie Corporation of New York to carry on its work. This grant extends through 1963. Staff offices are located on the campus of Purdue University at Lafayette, Indiana.

COMMITTEE MEMBERS

University of Chicago	R. W. Harrison, vice president and dean of faculties
University of Illinois	L. H. Lanier, vice president and provost
Indiana University	R. L. Collins, vice president and dean of faculties
State University of Iowa	H. H. Davis, provost
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Northwestern University	J. L. Shanley, associate dean, College of Liberal Arts
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Purdue University	D. R. Mallett, executive dean
The University of Wisconsin	F. H. Harrington, vice president of academic affairs (chairman)

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J. W. Hicks, director
S. F. Salwak, associate director

University Facilities Research Center

In 1960, the Committee on Institutional Cooperation was awarded a special grant from Educational Facilities Laboratories, Inc. to facilitate cooperation among the eleven universities in programs for expansion of their building and educational facilities in anticipation of greatly increased enrollments projected for the 1960's. The Research Center was then organized, located on the campus of The University of Wisconsin at Madison to: (1) Serve as a clearinghouse for information about educational facilities among the eleven institutions, (2) Serve as a central repository for educational facilities research gathered from national sources relevant to the interests of the eleven universities, (3) Conduct facilities research on matters of common interest, and (4) Make available to other educational institutions information about outstanding practices already employed in any one or more of the eleven universities, or which may be developed under the grant.

The activities of the Research Center are conducted by a small staff, assisted by consultants drawn from either private architectural and engineering firms experienced in college and university facilities design and planning, or from university faculties and staff.

UNIVERSITY FACILITIES RESEARCH CENTER

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Madison 6, Wisconsin

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W. S. Kinne, Jr., A. I. A., director
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Educational Facilities Laboratories Inc.

477 Madison Avenue, New York 22, New York

This organization is a nonprofit corporation established in 1958 by the Ford Foundation to help American schools and colleges with their physical problems by the encouragement of research and experimentation and the dissemination of knowledge regarding educational facilities.

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